

REMARKS

Applicant respectfully requests reconsideration. Claims 11-42 were previously pending in this application. Claim 12 has been amended for clarity. New claims 43-48 have been added. The new claims are supported in the specification. No new matter has been added. Claims 11-48 are now pending for examination, with claims 11 and 32 being independent claims.

Rejections Under 35 U.S.C. §103(a) over Otsuka in view of Meyerson

Claims 11-16, 18, 22, 28-30 and 32-38 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 4,401,506 (Otsuka) in view of U.S. Patent No. 5,298,452 (Meyerson). The Office Action states that it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Otsuka's method of forming epitaxial silicon with Meyerson's process of forming epitaxial silicon at reduced temperatures to form an epitaxial silicon layer with excellent uniformity at reduced operating temperatures. Applicant respectfully traverses this rejection.

Otsuka is directed to a process for producing a semiconductor device that uses a conventional epitaxial growth step after an implantation step to form an oxygen layer at the surface of the device. In the Example, the concentration of oxygen at the substrate surface is *greater than $5 \times 10^{17} \text{ cm}^{-3}$* . (Emphasis added). Otsuka describes the production of high-quality devices and does not disclose any problems associated with, or the need to improve, epitaxial layer uniformity.

Meyerson discloses an epitaxial growth process that is performed using extremely low base pressures which are several orders of magnitude below conventional processes (e.g., See Column 4, lines 57-61). Meyerson uses the low pressures, in part, to maintain *oxygen-free substrate surfaces* which are required for the process. (e.g., See Column 8, line 67 – Column 9, line 2). (Emphasis added) To achieve and maintain these extreme, ultra-high vacuum pressure conditions, Meyerson uses stringent processing conditions and a non-conventional, complex apparatus (e.g., See Fig. 1; Column 6, line 45 - Column 8, line 23; Column 7, lines 43-44; Column 8, lines 46-50). The Office Action notes that Meyerson describes that films having excellent uniformity may be grown.

Because the Otsuka process grows epitaxial silicon layers on substrates having oxygen-rich surfaces and the Meyerson epitaxial growth process requires oxygen-free surfaces, the references teach away from modifying Otsuka to include the Meyerson epitaxial growth process. Furthermore, because of the difficulties associated with the Meyerson epitaxial deposition step and the lack of need for improvements in epitaxial layer uniformity in Otsuka's device, one of ordinary skill in the art would also have not been motivated to modify Otsuka's method to include the Meyerson epitaxial growth step.

Because one of ordinary skill in the art would not have been motivated to combine the references and, in fact, the references teach away from the proposed combination, a prima facie case of obviousness has not been met. Accordingly, Applicant respectfully requests withdrawal of the rejection of claims 11-16, 18, 22, 28-30 and 32-38 under 35 U.S.C. §103(a) as being unpatentable over Otsuka in view of Meyerson for at least this reason.

Furthermore, even if Otsuka was modified in view of Meyerson as suggested in the Office Action, the combination would not teach or suggest all of the limitations of independent claim 32. In particular, the combination would not teach or suggest the step of depositing a single-crystal silicon layer on a substrate, wherein the silicon layer has a *different crystalline orientation* than the substrate. (Emphasis added)

In the Office Action, it is recognized that the combination of Otsuka and Meyerson is silent as to the crystalline orientation of the silicon layer with respect to that of the substrate. Although, the Office Action asserts that the deposited silicon layer taught by the Meyerson and Otsuka combination would inherently have a different orientation than the substrate because the combination purportedly teaches the claimed method.

To begin with, the Applicant points out that the burden is on the Patent Office to establish the inherency in the prior art of each and every claim limitation.¹ The Office Action fails to meet this burden by failing to provide any reasonable rational or technical reasoning to support the proposition that the deposited silicon layer resulting from the combination of Otsuka and Meyerson would necessarily have a different orientation than the substrate as recited in independent claim 32.

The Office Action appears to rely on the assertion that the combination of Otsuka and Meyerson teach certain steps (presumably, defect formation and layer deposition steps) of the claimed method. However, the Meyerson layer deposition process is very different than the process described in the present application which can result in silicon layers having a different crystalline orientation than the substrate. As noted above, Meyerson utilizes extremely low pressures, in part, so that non-equilibrium processes dominate the growth of the deposited layer. (See, e.g., Column 4, lines 29-34). Under such growth conditions and non-equilibrium processes, there is no reason to believe that the deposited layer would have a different orientation than the substrate as claimed, even if the film is grown on a substrate that includes defects. In fact, Meyerson emphasizes how the growth process described therein enhances epitaxial deposition. As known to those skilled in the art, epitaxial silicon layers exhibit the same crystalline orientation as the substrate on which it is formed, in contrast to the limitation in claim 32.

Because the Office Action has not established the necessary burden required to support the inherency rejection, independent claim 32 is patentable over the combination of Meyerson in view of Otsuka. Claims 33-38 depend from claim 32 and, therefore, are also patentable over the

¹ To meet this burden, "the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art" (MPEP §2112 quoting Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Int. 1990)(emphasis in original quotation)). The fact that a certain characteristic may be present in the prior art is not sufficient to establish the inherency of that result or characteristic (see MPEP §2112). The limitation must necessarily be present in the teachings of the prior art, such that it would be recognized as such by persons of ordinary skill in the art (MPEP §2112 and §2131.01). Inherency may not be established by mere probabilities or possibilities (MPEP §2112).

combination. Accordingly, Applicant respectfully requests withdrawal of the rejection of these claims as being unpatentable over Otsuka in view of Meyerson for at least this reason.

Rejections Under 35 U.S.C. §103(a) over Chang in view of Meyerson

Claims 11-42 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,028,556 (Chang) in view of U.S. Patent No. 5,298,452 (Meyerson). The Office Action states that it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chang's method of forming epitaxial silicon with Meyerson's process of forming epitaxial silicon at reduced temperatures to form an epitaxial silicon layer with excellent uniformity at reduced operating temperatures. Applicant respectfully traverses this rejection.

Chang is directed to a process for producing a semiconductor device that uses a conventional epitaxial growth step after an implantation step. Chang does not disclose any problems associated with, or the need to improve, epitaxial layer uniformity.

Meyerson was described above in connection with the rejection of Otsuka in view of Meyerson.

Because of the difficulties (e.g., stringent process conditions; complex, non-conventional apparatus) required with the Meyerson epitaxial deposition step and the lack of need for improvements in epitaxial layer uniformity in Chang's device, one of ordinary skill in the art would also have not been motivated to modify Chang's method to include the Meyerson epitaxial growth step. Without such a motivation, a prima facie case of obviousness has not been met. Accordingly, Applicant respectfully requests withdrawal of the rejection of claims 11-42 under 35 U.S.C. §103(a) as being unpatentable over Chang in view of Meyerson for at least this reason.

Furthermore, even if Chang was modified in view of Meyerson as suggested in the Office Action, the combination would not teach or suggest all of the limitations of claim 32. In particular, the combination would not teach or suggest the step of depositing a single-crystal silicon layer on a substrate, wherein the silicon layer has a *different crystalline orientation* than the substrate. (Emphasis added)

In the Office Action, it is recognized that the combination of Chang and Meyerson is silent as to the crystalline orientation of the silicon layer with respect to that of the substrate. Although, the Office Action asserts that the deposited silicon layer taught by the Chang and Meyerson combination would inherently have a different orientation than the substrate because the combination purportedly teaches the claimed method.

Applicant discussed above the burden on the Patent Office in order to establish an inherency. The Office Action fails to meet this burden by failing to provide any reasonable rational or technical reasoning to support the proposition that the deposited silicon layer resulting from the combination of Chang and Meyerson would necessarily have a different orientation than the substrate as recited in independent claim 32.

The Office Action appears to rely on the assertion that the combination of Chang and Meyerson teach certain steps (presumably, defect formation and layer deposition steps) of the claimed method. However, the Meyerson layer deposition process is very different than the process described in the present application which can result in silicon layers having a different crystalline orientation than the substrate. As noted above, Meyerson utilizes extremely low pressures, in part, so that non-equilibrium processes dominate the growth of the deposited layer. (See, e.g., Column 4, lines 29-34). Under such growth conditions and non-equilibrium processes, there is no reason to believe that the deposited layer would have a different orientation than the substrate as claimed, even if the film is grown on a substrate that includes defects. In fact, Meyerson emphasizes how the growth process described therein enhances epitaxial deposition. As known to those skilled in the art, epitaxial silicon layers exhibit the same crystalline orientation as the substrate on which it is formed, in contrast to the limitation in claim 32.

Because the Office Action has not established the necessary burden required to support the inherency rejection, independent claim 32 is patentable over the combination of Meyerson in view of Chang. Claims 33-38 depend from claim 32 and, therefore, are also patentable over the combination. Accordingly, Applicant respectfully requests withdrawal of the rejection of these claims as being unpatentable over Chang in view of Meyerson for at least this reason.

Double Patenting Rejections

Claims 11, 16, 17, 19, 20, 21, 23-32, 34, 35 and 38-42 were rejected under the judicially created doctrine of obviousness-type double-patenting as being unpatentable over claims 1-8 of U.S. Patent No. 6,165,265 (Gris). Without acceding to the correctness of this rejection, Applicant is filing herewith a Terminal Disclaimer to overcome this rejection. Accordingly, Applicant respectfully requests withdrawal of rejection of claims 11, 16, 17, 19, 20, 21, 23-32, 34, 35 and 38-42 on this ground.

Claims 13-15 and 36-37 were rejected under the judicially created doctrine of obviousness-type double-patenting as being unpatentable over claims 1-8 of Gris in view of Meyerson. Without acceding to the correctness of this rejection, Applicant is filing herewith a Terminal Disclaimer to overcome this rejection. Accordingly, Applicant respectfully requests withdrawal of the rejections of claims 13-15 and 36-37 on this ground.

Claims 12, 18, 22 and 33 were rejected under the judicially created doctrine of obviousness-type double-patenting as being unpatentable over claims 1-8 of Gris. Without acceding to the correctness of this rejection, Applicant is filing herewith a Terminal Disclaimer to overcome this rejection. Accordingly, Applicant respectfully requests withdrawal of the rejections of claims 12, 18, 22 and 33 on this ground.

New Claims

New claims 43-48 depend from currently pending independent claims 11 or 32. The new claims are, therefore, patentable over the cited references for at least the reasons that their respective independent claims are patentable as described above.

Serial No.: 09/336,091
Conf. No. 8198

- 12 -

Art Unit: 1644

CONCLUSION

In view of the foregoing amendments and remarks, this application should now be in condition for allowance. A notice to this effect is respectfully requested. If the Examiner believes, after this amendment, that the application is not in condition for allowance, the Examiner is requested to call the Applicant's attorney at the telephone number listed below.

If this response is not considered timely filed and if a request for an extension of time is otherwise absent, Applicant hereby requests any necessary extension of time. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 23/2825.

Respectfully submitted,
Yvon Gris et al., Applicant

By: 

Robert H. Walat, Reg. No.: 46,324
James H. Morris, Reg. No.: 34,681
Wolf, Greenfield & Sacks, P.C.
600 Atlantic Avenue
Boston, Massachusetts 02210-2211
Telephone: (617)720-3500

Docket No. S01022.80800.US
Date: July 23, 2003
x07/23/2003x